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THE FLORA OF LIMESINK DEPRESSIONS IN CAROLINA BEACH STATE PARK (NORTH CAROLINA)

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ABSTRACT

Seven selected limesink depressions in Carolina Beach State Park (New Hanover County, North Carolina) were floristically surveyed in 1990. One state record, 11 county records, and 28 species of special interest or concern are among the 108 vascular plant species collected or observed.

Key Words: Vascular plants, limesink depressions, distribution records, North Carolina

INTRODUCTION

As part of a general floristic survey of the vascular plants of Carolina Beach State Park (New Hanover County, North Carolina), seven selected limesink depressions were studied from January through December 1990. Such depressions are reportedly formed by the slumping of surface soils following fracture and dissolution of underlying limestone (McDonald et al., 1981; Taggart and Dickerson, 1980); those chosen exhibited a variety of types, from very dry to very wet, and with and without woods. For purposes of identification and description, the depressions were assigned the following names: (1) Sawgrass Pond (a small, elliptical depression ca. 29 m × 53 m at its widest points with a population of sawgrass in its center), (2) Loblolly Pond (a shallow, dry depression ca. 40 m × 56 m with numerous small loblolly pines scattered throughout), (3) Lily Pond (a large pond ca. 66 m × 150 m, normally aquatic with standing water and water lilies), (4) Cypress Pond (a partially wooded depression with numerous pond cypresses. This depression consists of east and west sections which in most years are separated by a dry ridge and which often have standing water in their centers. In wet years such as 1991, they can be one continuous pond; together they are ca. 61 m wide × 218 m long), (5) Dry Pond (ca. 25 m × 84 m, drier and more shallow than the others, usually without standing water), (6) Gum Pond (a nearly round depression ca. 48 m in diameter, partially

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wooded with numerous pond cypresses and black gums), and (7) Grass Pond (ca. 41 m × 109 m, dominated by grasses and other herbaceous vegetation). All of the limesinks surveyed are surrounded by longleaf pine–scrub oak communities, and they grade from their moist or aquatic centers or low areas upward to surrounding xeric sand ridges, often having distinct vegetation zones with increasing elevation.

The limesinks were surveyed on 26 weekly trips, primarily during the active growing season, March through October; known species were recorded and unknowns were collected and identified. The 249 voucher specimens have been deposited in WNC; nomenclature follows that of Kartesz and Kartesz (1980). In the species list, synonyms from Radford et al. (1968) are given in brackets following those taxa with name changes.

SPECIES LIST

Pteridophyta

BLECHNACEAE

Woodwardia virginica (L.) Smith

LYCOPODIACEAE

Lycopodium alopecuroides L.
Lycopodium appressum (Chapman) Lloyd & Underwood
Lycopodium carolinianum L.

OSMUNDACEAE

Osmunda regalis L. var. *spectabilis* (Willd.) Gray

Gymnospermae

PINACEAE

Pinus taeda L.

TAXODIACEAE

Taxodium ascendens Brongn.

Angiospermae

ACERACEAE

Acer rubrum L.

ANACARDIACEAE

Toxicodendron radicans (L.) Kuntze. [*Rhus radicans* L.]

APIACEAE

Centella asiatica (L.) Urban
Oxypolis filiformis (Walt.) Britt.

AQUIFOLIACEAE

Ilex cassine L.
Ilex glabra (L.) Gray

ASTERACEAE

Coreopsis falcata Boynt.
Erechtites hieracifolia (L.) Raf. ex DC.
Eupatorium capillifolium (Lam.) Small
Eupatorium leptophyllum DC. [*Eupatorium capillifolium* var. *leptophyllum* (DC.) Ahles]
Eupatorium recurvans Small
Euthamia tenuifolia (Pursh) Greene [*Solidago microcephala* (Greene) Bush]
Pluchea rosea Godfrey

BROMELIACEAE

Tillandsia usneoides (L.) L.

BURMANNIACEAE

Burmannia biflora L.
Burmannia capitata (Walt.) Mart.

CAMPANULACEAE

Lobelia nutallii Roemer & Schultes

CLUSIACEAE [HYPERICACEAE]
Hypericum cistifolium Lam.
Hypericum reductum P. Adams

CYPERACEAE
Cladium jamaicense Crantz
Cyperus polystachyos Rottb. var *texensis* (Torrey) Fern.
Eleocharis equisetoides (Ell.) Torr.
Eleocharis melanocarpa Torr.
Psilocarya scirpoides Torr.
Rhynchospora chalarocephala Fern. & Gale
Rhynchospora chapmanii M. A. Curtis
Rhynchospora corniculata (Lam.) Gray
Rhynchospora filifolia Gray
Rhynchospora inundata (Oakes) Fern.
Rhynchospora pleiantha (Kükenthal) Gale
Rhynchospora plumosa Ell.
Rhynchospora tracyi Britt.
Rhynchospora wrightiana Boeckl.
Scleria georgiana Core
Scleria reticularis Michx. var. *pubescens* Britt.

CYRILLACEAE
Cyrilla racemiflora L.

DROSERACEAE
Drosera capillaris Poiret
Drosera intermedia Hayne

EBENACEAE
Diospyros virginiana L.

ERICACEAE
Lyonia lucida (Lam.) K. Koch
Lyonia mariana (L.) D. Don
Vaccinium corymbosum L. [*Vaccinium atrococcum* (Gray) Porter]

ERIOCAULACEAE

Eriocaulon compressum Lam.
Lachnocaulon beyrichianum Sporleder. ex Koern.

GENTIANACEAE

Bartonia paniculata (Michx.) Muhl.
Bartonia verna (Michx.) Muhl.
Sabatia difformis (L.) Druce

HALORAGIDACEAE

Proserpinaca pectinata Lam.

HAMAMELIDACEAE

Liquidambar styraciflua L.

JUNCACEAE

Juncus abortvus Chapman
Juncus scirpoides Lam.

LAURACEAE

Persea borbonia (L.) Sprengel.

LENTIBULARIACEAE

Pinguicula caerulea Walt.
Utricularia juncea Vahl.
Utricularia purpurea Walt.
Utricularia subulata L.

LINACEAE

Linum floridanum (Planch.) Trel. var *floridanum* [*Linum virginianum* L. var. *floridanum* Planch.]

MAGNOLIACEAE

Magnolia virginiana L.

MELASTOMATACEAE

Rhexia cubensis Griseb.
Rhexia mariana L. var. *mariana*

MYRICACEAE

Myrica cerifera L.

NYMPHAEACEAE

Nymphaea odorata Ait.

NYSSACEAE

Nyssa sylvatica Marsh var. *biflora* (Walter) Sargent

ONAGRACEAE

Ludwigia linifolia Poir.
Ludwigia suffruticosa Walt.

ORCHIDACEAE

Pogonia ophioglossoides (L.) Juss.

POACEAE

Andropogon capillipes Nash [*A. virginicus* L., in part]
Andropogon perangustatus Nash
Andropogon virginicus L. var. *virginicus*
Aristida affinis (Schultes) Kunth.
Aristida purpurascens Poir.
Aristida virgata Trin.
Coelorachis rugosa (Nutt.) Nash [*Manisuris rugosa* (Nutt.) Kuntze]
Dichanthelium acuminatum (Sw.) Gould & Clark var. *longiligulatum* (Nash) Gould & Clark [*Panicum longiligulatum* Nash]
Dichanthelium dichotomum (L.) Gould var. *ensifolium* (Baldw. ex Ell.) Gould & Clark [*Panicum ensifolium* Baldwin ex Ell.]
Eragrostis refracta (Muhl.) Scribn.
Erianthus giganteus (Walt.) Muhl.
Panicum rigidulum Bosc ex Nees [*Panicum agrostoides* Spreng.]
Panicum tenerum Bey. ex Trin.
Panicum verrucosum Muhl.
Panicum virgatum L.
Paspalum praecox Walt.
Sacciolepis striata (L.) Nash
Setaria magna Griseb.

POLYGALACEAE

Polygala cruciata Nutt.
Polygala cymosa Walt.
Polygala lutea L.

POLYGONACEAE

Polygonum opelousanum Riddell ex Small [*Polygonum hydropiperoides* Michx. var. *opelousanum* (Riddell ex Small) Stone]
Polygonum persicaria L.

RUBIACEAE

Diodia virginiana L.

SALICACEAE

Salix nigra Marsh

SAXIFRAGACEAE

Itea virginica L.

SCROPHULARIACEAE

Agalinis fasciculata (Ell.) Raf.
Agalinis linifolia (Nutt.) Britt.
Agalinis virgata Raf.

SMILACACEAE

Smilax laurifolia L.

VIOLACEAE

Viola lanceolata L.

XYRIDACEAE

Xyris ambigua Bey. ex Kunth.
Xyris caroliniana Walt.
Xyris jupicai L.
Xyris smalliana Nash

DISCUSSION

Following Schafale and Weakley (1990), limesinks in the Park can be classified as either Depression Pocosins, Small Depression Ponds, or Vernal Pools. Depression Pocosins are characterized by a dense to fairly dense shrub layer and a sparse to fairly dense tree layer. Of the limesinks surveyed, only Gum Pond with its canopy of black gum, pond cypress, and red maple fits that description. Small Depression Ponds are permanently or nearly permanently flooded in the center and may have scattered pond cypresses and black gums. Cypress Pond is an example of a small depression pond, although a portion of its east section has characteristics of a vernal pool. Vernal Pools are seasonally flooded depressions dominated by herbs, although there may be a few wetland trees or shrubs in the depression interior. In the park, vernal pools include Grass, Dry, Lily, Loblolly, and Sawgrass Ponds. In many cases, classification of limesinks is difficult when characteristics overlap two or more of these community types. According to Schafale and Weakley (1990), "Differences in hydroperiod seem to be responsible for the different vegetation of the community types. The three types may represent different stages in primary succession, which is proceeding at different rates in different depressions." Seasonal fluctuation in water levels and its variation among years appears to be an important factor in determining presence of plant species. Because the ponds have no surface exits, they hold water fairly well in wet years. The deepest ponds may have several feet of standing water; in dry years they may be completely dry. During the growing season that these limesinks were surveyed, most of the depressions had some standing water from January to April, then gradually dried and were without standing water for the remaining months, although soils in the deepest parts remained moist. The water table was reported to be several inches lower than usual in southeastern North Carolina during that year (D. M. DuMond, pers. comm.); as a result, some species such as *Eleocharis equisetoides* which had been reported previously were not encountered. It is likely that in a wet year additional species would be apparent. For example, *Utricularia purpurea* Walt., not seen in 1990, was reported to be in the Grass Pond in 1991 (J. Fowler, pers. comm.) and was observed in the Cypress Pond; the summer of 1991 was quite rainy. On the other hand, many rare species found in the

ponds would not be apparent during a rainy season because they would be under water. The limesinks were observed again in September 1991 and most were still full of standing water. Dry Pond had none, but its soil was quite moist; Loblolly Pond had shallow water covering about one-half its total area.

These limesinks are especially rich in species of special interest or concern because of rarity. The state record (with voucher citation in parentheses) is *Andropogon perangustatus* (*Sieren 4120*), which was found growing abundantly in moist parts of Gum Pond and the east section of Cypress Pond. Hitchcock (1951) indicated its habitat and range as "Bogs and moist pine woods, Florida and Mississippi." New Hanover county records include *Aristida affinis* (*Sieren 4095*), *A. purpurascens* (*Sieren 4127*), *A. virgata* (*Sieren 4136*), *Bartonia paniculata* (*Sieren 4094*), *Eragrostis refracta* (*Sieren 4105*), *Eupatorium leptophyllum* (*Sieren 4097*), *Linum floridanum* var. *floridanum* (*Sieren 4044*), *Lycopodium carolinianum* (*Sieren 4057*), *Paspalum praecox* (*Sieren 4049*), *Rhynchospora inundata* (*Sieren 4028*), and *Utricularia juncea* (*Sieren 4108*).

Fifteen species are on the Natural Heritage Program List of the Rare Plants of North Carolina (Weakley, 1990): *Agalinis linifolia* (occasional to locally abundant in all seven ponds), *A. virgata* (scattered to locally abundant in Cypress, Dry, Grass, Gum, and Sawgrass Ponds), *Aristida affinis* (occasional to frequent in Cypress, Grass, Gum, and Sawgrass Ponds), *Eleocharis equisetoides* (previously observed and photographed in Cypress Pond), *E. melanocarpa* (frequent and abundant in Loblolly Pond), *Eupatorium leptophyllum* (scattered under pond cypresses in Cypress Pond), *Lachnocaulon beyrichianum* (frequent in the woods/pond ecotones around Cypress, Dry, Grass, Gum and Loblolly Ponds), *Ludwigia linifolia* (scattered to abundant in Cypress and Grass Ponds), *L. suffruticosa* (frequent in Cypress and Sawgrass Ponds), *Panicum tenerum* (occasional in Cypress Pond), *Psilocarya scirpoides* (abundant in Lily Pond), *Rhexia cubensis* (scattered to numerous in Dry, Cypress, Grass, and Gum Ponds), *Rhynchospora pleiantha* (abundant in patches in Dry, Grass, and Cypress Ponds), *R. tracyi* (several plants in Cypress and Sawgrass Ponds), and *Scleria georgiana* (scattered in Dry and Sawgrass Ponds). An additional 13 species are on the North Carolina Watch List which includes plant species that appear to be rare or otherwise threatened with serious decline, but which have not yet been placed on

the Rare Plant List of North Carolina (Weakley, 1990). These species are *Agalinis fasciculata* (one plant in the Sawgrass Pond), *Andropogon capillipes* (scattered to abundant on the dry margins of Dry, Cypress, Loblolly, and Sawgrass Ponds and also observed in a pocosin/savannah ecotone and in other scattered depressions in the park), *Bartonia paniculata* (scattered in Cypress, Grass, and Sawgrass Ponds), *B. verna* (frequent to numerous in Grass, Gum, and Sawgrass Ponds), *Burmannia biflora* (several plants in Sawgrass Pond), *Coelorachis rugosa* (few to numerous in Gum and Sawgrass Ponds), *Ilex cassine* (occasional to numerous on the dry margins of all seven ponds), *Juncus abortivus* (scattered to locally numerous in Cypress, Dry, Grass, and Sawgrass Ponds and also observed in two pocosins in the park), *Paspalum praecox* (occasional in Sawgrass Pond), *Rhynchospora filifolia* (locally abundant in Cypress and Gum Ponds), *R. inundata* (abundant in Lily Pond, the dominant herb in mid-summer), *R. wrightiana* (locally abundant in Loblolly and Sawgrass Ponds), and *Xyris smalliana* (occasional in Grass Pond).

Cypress Pond, which has the greatest variety of habitats, also has the largest number of rare or watch list species (18), followed by Sawgrass Pond with 15, Grass Pond with 12, Dry and Gum Ponds with 8 each, Loblolly Pond with 5, and Lily Pond with 3.

Vegetation of the limesinks is clearly denser and more diverse than that of the surrounding longleaf pine–scrub oak communities. Mesic depressions have the most diversity, and it is assumed that an appropriate amount of moisture is significant in the distribution of limesink species. The presence of so many rare species in the depressions suggests that there may be a unique combination of factors responsible. Beal (1977) provided habitat data for many marsh and aquatic vascular plants of North Carolina, including eight of the rare species found in the limesinks. An analysis of Beal's data for the pH of the habitats for those eight species indicated that most were growing in sites that were neutral to alkaline. Three of the species were collected at least once in conditions which were acid (pH 4–4.9), but two of those were also collected in alkaline sites. Similarly, chloride content for most species was between 0–1 ppm, but in two cases those limits were exceeded. A study of limesinks for these and other environmental factors should provide a greater understanding of conditions controlling the distribution of limesink species.

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